

## Nuclear Science Division Newsletter

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January, 2015

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### NSD Welcomes Barbara Jacak as our new director

LBNL's Nuclear Science Division welcomes Dr. Barbara Jacak as our new director. In a Jan. 12<sup>th</sup> ceremonial changing of the guard, LBNL director Paul Alivisatos, deputy director Horst Simon and associate director James Symons welcomed Jacak and thanked outgoing acting NSD director Rod Clark for his service.

Dr. Jacak comes to the NSD from Stony Brook University, where she was a Distinguished Professor of Physics. Her research interests are centered on relativistic heavy ion collisions; most of her recent work was at RHIC, where she served two terms as PHENIX spokesperson, from 2007 through 2012. Dr. Jacak and her students have focused on how quarks and gluons lose energy in quark gluon plasmas and, more recently, measuring possible energy loss in cold nuclear matter (pA collisions). Previous to Stony Brook, she was a staff member in the Physics Division at Los Alamos National Laboratory, where she worked on the HELIOS and NA-44 experiments, which studied heavy ion collisions at CERN's SPS accelerator. She received her PhD in 1984 from Michigan State University, where she measured multi-fragmentation of nuclei in intermediate energy collisions at the now-dismantled LBNL Bevalac.



Dr. Jacak brings to the job impeccable scientific credentials, as a member of the National Academy of Science and a fellow of the American Physical Society and the AAAS. In addition to her LBNL appointment, Dr. Jacak has a faculty appointment in the UC Berkeley Physics Department. She is also no stranger to Berkeley; she is a native of Alameda, and did her undergraduate work at Cal.

Dr. Jacak reports that she is very excited to be returning to Berkeley, "I'm inspired by the wide range of exciting science in the Nuclear Science Division. I look forward to learning many new things and figuring out how I can help. At the moment, I'm also looking forward to getting settled in Berkeley."

Dr. Jacak was selected after a national search. She will replace acting director Rod Clark, who is turning his focus back to studies of nuclear structure.

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### FIONA Isotope Separator commissioned at 88-Inch Cyclotron

Over the last 15 years, a collaboration working at the Flerov Laboratory for Nuclear Reactions has discovered six new superheavy (SHE) elements, assumed to have atomic number,  $Z=112-118$  in reactions between actinide targets and  $^{48}\text{Ca}$  beams. Since 2007, experiments conducted at Berkeley Lab and the GSI Helmholtz Center for Heavy Ion Research have independently confirmed the production of elements assigned to  $Z=112$  and  $114-117$ . However, a decade old question remains: where do they belong on the chart of nuclides? Nature has not been kind – the SHE isotopes discovered in recent years decay through a series of  $\alpha$  decays that terminate in spontaneous fission without passing through known nuclides. With no decay connection to nuclides for which atomic mass and numbers are firmly established, the assignments for these new SHE isotopes are based primarily on nuclear mass models.

At Berkeley Lab, we are building a mass analyzer that will allow for the first determination of SHE mass numbers. The mass analyzer, FIONA, uses perpendicular magnetic and electric fields, such that ions take trochoidal, or looping, trajectories through the mass analyzer. The pitch of each loop is determined by the mass/charge ratio of the ion, thus providing separation as the ions exit the mass analyzer. This separation increases with the number of loops taken by the ions. Since a separator of this type has never been built before, a setup was built in cave 4C at the 88-Inch Cyclotron to test the separation principle. Commissioning of FIONA with natural xenon isotopes began earlier this fall and separation of xenon isotopes was observed during the first week of December. Optimization of FIONA will continue through the winter, followed by installation of FIONA behind the Berkeley Gas-filled Separator at the 88-Inch Cyclotron. There, the combined BGS+FIONA will provide mass-separated isotopes to a low  $\gamma$ -ray and neutron background region on a milliseconds time scale. This will allow for determination of SHE masses, as well as detailed studies on the decay properties and nuclear structure of SHE and other nuclides with  $Z=100-118$ , greatly expanding the scientific research program at the 88-Inch Cyclotron.

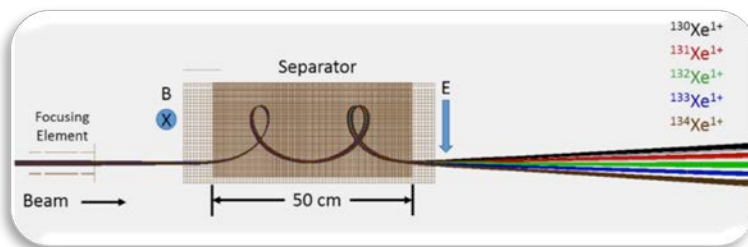


Figure 1 Simulated trajectories of  $^{130-134}\text{Xe}^{1+}$  ions through FIONA.

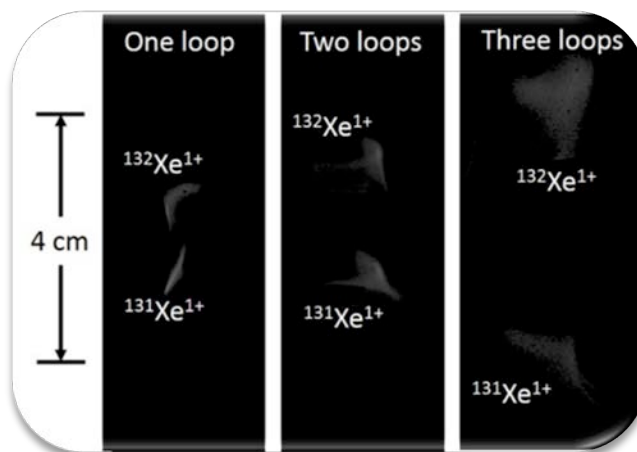


Figure 2. Separation of different masses of xenon observed on a multi-channel plate detector positioned one meter downstream of the exit of FIONA. The ions are taking one, two or three loops through the separator.

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### ALICE EMCal gets company: DCal

Installation of the DCal, the second component of the ALICE Di-Jet calorimeter detector, was completed in late October 2014, two weeks ahead of its scheduled installation window. The DCal is situated in the ALICE central barrel, 180 degrees in azimuth from the EMCal, and completes the calorimetric coverage of the open regions of ALICE. This configuration enables back-to-back coincidence measurements of jets with various triggers, including jets, photons, and high momentum hadrons and electrons. The DCal thereby expands the ALICE jet program significantly.



Members of the DCal installation team in the ALICE detector. The recently completed DCal is hanging above their heads.

The DCal structure, which is identical to that of the ALICE EMCal, is based on supermodules, each of which consists of 1100 individual calorimeter towers and weigh about 8 tons. The DCal is made up of six full-sized supermodules and two 1/3-sized supermodules.

The DCal was not initially part of the EMCal project, but with successful completion of the EMCal project in 2011 it was added with no additional cost to DOE. The DCal effort required redesign of the ALICE support structure, fabrication and assembly of the DCal components, and finally, integration and installation of the full detector in ALICE. Engineering effort was led by the ALICE team from Nantes, France, and the project was managed by Lawrence Berkeley National Laboratory. The success of this project is due to the great effort of many members of the collaboration and the ALICE Integration Team.



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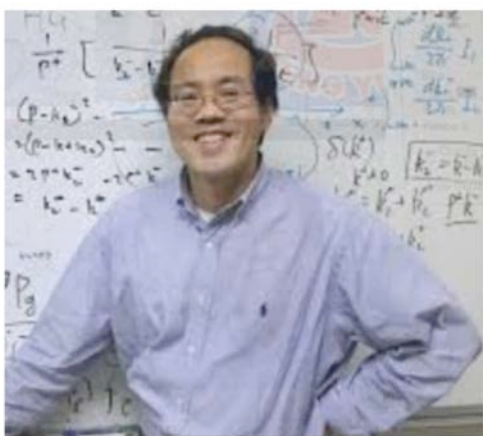
### Fragments

NSD's Howard Wieman has won the APS Division of Nuclear Physics Tom W. Bonner Prize for "For developing foundational experimental and theoretical tools to enable and guide generations of experiments in relativistic heavy ion physics. The combination of experiment and theory led to the initial discoveries at RHIC, ongoing precision studies of the properties of hot nuclear matter, and to exploration of the nuclear matter phase diagram." Wieman shared the prize with Columbia University's Prof. Miklos Gyulassy.

Wieman and Gyulassy were feted the feted at a Jan. 10<sup>th</sup> symposium in their honor; the photo (right) shows them sandwiched between two previous Bonner Prize winners: Art Poskanzer (LBNL) and Bill Zajc (Columbia).



The Nuclear Science Division congratulates Alan Poon and Feng Yuan on

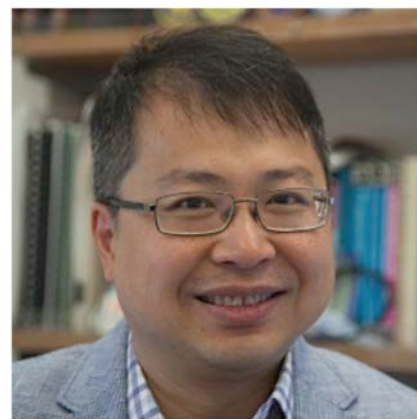


their selection as APS fellows. Alan was selected "For significant contributions to

understanding fundamental neutrino properties through solar neutrinos, reactor neutrinos, beta decay, and neutrinoless double-beta decay experiments

and for the resulting discoveries of physics requiring significant modification of the standard model." Feng

received his award "For his seminal contributions to the understanding of the quark and gluon structure of the nucleon and nucleus, especially, in the areas of the transverse-momentum dependent parton distributions and their factorization, nucleon spin structure, and gluon saturation in QCD."



## Nuclear Science Division Newsletter



The NSD hosted over 120 experimentalist and theorists for 5 days of discussion at the “Initial States 2014” conference in Napa. The meeting covered recent experimental and theoretical developments concerning the initial states of the nuclei used in relativistic heavy ion collisions. One focus of the meeting was why many of the phenomena seen in AA collisions, and attributed to the quark-gluon plasma, are also seen in pA and even high-multiplicity pp collisions.

Dr. Shanshan Cao joined the Nuclear Theory Group as a postdoctoral fellow this September, after receiving his PhD from Duke University this summer. His research focuses on heavy quark transport in quark-gluon plasma in high-energy heavy-ion collisions. He is a member of the JET topical collaboration and his work is closely related to physics of HFT in the RNC group.

Dorothy Kenlow and Kymba A’Hearn have joined the 88-Inch Cyclotron, where they will provide user and administrative support. They replace long-time NSD employees Daphne Trowbridge-Williams (who has moved to Computing Sciences), and Michele Pixa (who is now in the Engineering Division).

Several holiday parties were held to celebrate the season. At the 88-Inch Cyclotron guests dined in the high-ceilinged formal dining room (aka “The Hi-bay”).



And the long-running Heavy Ion Tea seminar series had a special session focused on (non-alcoholic) thermodynamics, supplemented by plenty of solid matter studies.



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Welcoming the new NSD director, Barbara Jacak, is ALD for Physical Sciences James Symons. James was joined by LBNL Director Paul Alivisatos, Lab deputy director Horst Simon, and by former NSD acting director, Rod Clark, in ushering in the new Division guard. Shown below right is Barbara Jacak with Darlene Hoffman, who was an advisor and role model for Barbara.



**L-R: Lab deputy director Horst Simon; James Symons, Barbara Jacak, Paul Alivisatos, and Rod Clark.**



### Newsletter Notes

Please send any comments, including story suggestions to Spencer Klein at: [srklein@lbl.gov](mailto:srklein@lbl.gov). Previous issues of the newsletter are available at:

<https://commons.lbl.gov/display/nsd/NSD+Newsletter>

Newsletter layout of current and previous issues by Sandra Ritterbusch.